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ABSTRACT

The Group Embedded Figures Test and the Iowa Tests of Basic Skills were administered to 222 sixth grade students to explore the relationship between field-dependent/field-independent cognitive styles and reading achievement; scores from the Lorge-Thorndike Intelligence Tests were used to control IQ. The 60 students with the highest scores and the 60 with the lowest scores on the Group Embedded Figures Tests were selected to represent field-independent and field-dependent populations, respectively. No significant differences were found between field-dependent and field-independent students on vocabulary or comprehension scores when intelligence was controlled: the field-independent students scored high on intelligence and reading tests, and the field-dependent students scored low on both. Results were interpreted as indicating that the Group Embedded Figures Test draws on the same intellectual dimensions, as an IQ test and is a better indicator of intelligence than of reading ability. (Author/AA)

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THE RELATIONSHIP BETWEEN FIELD DEPENDENCE/FIELD INDEPENDENCE AND READING ACHIEVEMENT AT THE SIXTH GRADE

A THESIS

SUBMITTED TO THE FACULTY

OF THE GRADUATE SCHOOL OF EDUCATION

OF

RUTGERS

THE STATE UNIVERSITY OF NEW JERSEY

BY

JOSEPH J. DAKU

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CHAPTER I

THE PROBLEM

Central to current American educational processes is the need to know more about the student and how he learns. Educators are challenged by the problem of identifying ineffective reading behaviors and poor achievement while providing for individualized instruction in basic skills.

Improvement of reading "requires a broader look at the interaction between a student's cognitive-perceptual characteristics and the educational environment" (Davey, 1976). An understanding of individual needs, abilities, and of a student's environmental relationship which may effect his reading achievement is crucial.

Effective instruction requires improved information about the total student, that is, identification of differences in cognitive and personality patterns which may affect learning, as well as, in skills, strengths and weaknesses. An awareness of cognitive responses related to individual perceptual personalities may enable the reading teacher to develop and implement more appropriate teaching methods. To the extent that children differ, then methods for individualized instruction should also be different, e.g., according to cognitive learning styles (Kaplan, 1969).

Statement of the Problem

The purpose of this study was to investigate cognitive style and its relationship to reading achievement. Specifically, the intent of the study was to determine the relationship between field dependence/field independence and reading vocabulary/reading comprehension as differentiated by sex and I.Q. among sixth grade students.

Hypotheses

1. There will be no difference between field dependent or field independent students on vocabulary test scores when controlling for intelligence.

2. There will be no difference between field dependent or field independent students on reading comprehension test scores when controlling for intelligence.

3. There will be no difference between the number of males or females when comparing the field dependent/field independent groups.

Importance of the Study

An understanding of a particular student's cognitive style should aid the classroom teacher in the interpretation of an individual's performance in the classroom and on standardized tests. Students who function according to a particular cognitive and perceptual style perform better or worse depending upon the type of perceptual task presented to them. The study of cognitive styles for the use of individualization has significant possibilities. Presently, the student is expected to fit into existing individualized programs. After diagnostic testing, skills to be learned are listed for the student and appropriate work assigned.

Research suggests that students with a more field independent style learn better with an inductive approach while those with a more field dependent style might best benefit from a more teacher directed approach (Kogan 1971, Gordon 1966, Smith 1973).

Instructional considerations should begin with expanding the awareness of teachers to include cognitive style dimensions with the present behavioral and academic concepts. Attention should focus on the student's preference or ability to operate more effectively in one cognitive dimension over another with stress made on the possibility of flexibility in shifting from one style to another as the task requires. Reading approaches and materials should consider the student's cognitive style.

If significant differences in reading achievement due to cognitive styles are found, it might then suggest the usefulness of the practice of pretesting for cognitive style as a predictor of reading and/or school success. It would also suggest modification of lessons and tasks to suit the learning style of the individual. At the very least, an understanding of the learner's style might allow for modification and utilization of an educational approach which suits the instructional methods to the individual student's perceptual field dependent or field independent style (Chester, 1974).

Definition of Terms

Field Dependence and Field Independence--A principle of cognitive style which indicates the extent to which an individual

perceives part of a field as discrete from the surrounding field as a whole, rather than perceiving the part as embedded in the field. This "style" describes the approach an individual brings to a variety of situations which involves perceptual and intellectual functioning. It is the extent to which an individual perceives analytically along a continuum ranging from a global style, formulated as a totality, to an articulated style, formulated systematically. In a general sense, it is the extent or degree to which the individual perceives analytically.

Field Dependence--(FD) At one extreme of the performance continuum, as measured by any one of several embedded figures tests, the individual's perception is strongly dominated by the surrounding field and he has difficulty locating a simple figure when it is embedded in a more complex figure. FD individuals tend to be more global in their interaction with the environment and more social in nature.

Field Independence--(FI) At the other extreme, the individual perceives items as more or less separate from the surrounding field and is able to locate a simple figure when it is embedded in a more complex figure. FI individuals are more analytical, articulated, and tend to interact more actively with things in their environment.

Thus, when an individual's perceptual disembedding ability is high, he is designated "field independent" and when it is low, he is designated "field dependent."

Operationally, these styles were determined for this study by the correct number of responses on the Group Embedded Figures Test (GEFT) (Witkin, Oltman, Raskin and Karp, 1971).

Reading Vocabulary--For the purpose of this study, reading vocabulary was measured by the raw score on the vocabulary subtest of the Iowa Tests of Basic Skills, Form 4, Grades 3-9, 1964 edition (Lindquist and Hieronymus, 1964).

Reading Comprehension--For the purpose of this study, reading comprehension was measured by the raw score on the comprehension subtest of the Iowa Tests of Basic Skills, Form 4, Grades 3-9, 1964 edition (Lindquist and Hieronymus, 1964).

Limitations of the Study

The population in this study was a group of 240 sixth grade students in a middle to upper-middle income suburban school. The majority of these students come from homes where educational opportunities are manifold and education is considered to be important.

The use of a 1964 edition of a standardized test, based upon a 1955 edition, might be considered a limitation since it was normed at that time. However, this same edition has been used continuously at this grade level in this school for the last twelve years and has provided a satisfactory frame of reference.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

This chapter has four parts: the first, a general discussion of cognitive style; the second, a review of the literature dealing with field dependent and field independent styles; the third, a review of research which has examined the dimensions of field dependence/field independence and their relationships to reading ability; and the fourth, a discussion of the educational implications of the aforementioned research.

Cognitive Style

The educational implications of individualization for the educator and the students lie within the parameters of effectiveness, instructional techniques and accountability. For the educator, consideration of the diversity of students' abilities, achievements, values, attitudes, and personality traits should be an ongoing activity. For the student, individualization should mean instruction and practice through an educational approach which matches his strengths and needs. Within the last few decades, greater interest in cognitive styles inside the classroom has developed in addition to that of the clinic or laboratory. The emphasis on individual differences with regard to the concepts of individualized instruction

has shifted from a "straightforward predictor-criterion framework... to the interaction of personal cognitive and noncognitive characteristics with task and instructional variables" (Kogan, 1971, p. 244).

According to Witkin, Moore, Goodenough and Cox (1975), cognitive styles complement educational goals in the realms of ability and intelligence assessment, instructional variables, and learning strategies.

Cognitive styles can be defined as individual variations in modes of perceiving, remembering and thinking.

> First, cognitive styles are concerned with the form rather than the content of cognitive activity. They refer to individual differences in how we perceive, think, solve problems, learn, relate to others, etc. The definition of cognitive styles is thus cast in process terms.
>
> Second, cognitive styles are pervasive dimensions. They cut across the boundaries traditionally--and, we believe, inappropriately--used in compartmentalizing the human psyche and so help restore the psyche to its proper status as a holistic entity.
>
> A third characteristic of cognitive styles is that they are stable over time.
>
> Fourth, with regard to value judgments, cognitive styles are bipolar. This characteristic is of particular importance in distinguishing cognitive styles from intelligence and other ability dimensions (Witkin, Moore, Goodenough and Cox, 1975, pp. 21-23).

Kogan (1971) enumerated nine separate cognitive dimensions that have been the object of systematic, theoretical and empirical examination. These cognitive dimensions are:

1. Field independence vs. field dependence
2. Scanning

3. Breadth of categorizing
4. Conceptualizing styles
5. Cognitive complexity vs. simplicity
6. Reflectiveness vs. impulsivity
7. Leveling vs. sharpening
8. Constricted vs. flexible control
9. Tolerance for incongruous or unrealistic experiences (p. 246).

Of these nine styles, field independence (FI) and field dependence (FD) are probably the most widely known and researched. In this study FI and FD were the only dimensions of cognitive style studied and measured.

The purpose of discussing cognitive strengths is to relate them to effective learning. Learning and achievement in school, in the broadest sense, are the results of successfully operating within the educational framework of the classroom tasks, perception, learning style and teaching style. Much academic success in school has been related to reading ability and I.Q. Thus, primary consideration in this study will be given to the relationship of field dependence/field independence and reading.

If a particular cognitive style is found to be of critical value to the reading process, then a better understanding of the integration processes used in reading will also be better understood (Santostefano, 1965). Within the realm of educational individualization, there lie unanswered questions as to how a student perceives things, how his personality interacts with his perception and how these together affect his learning style within the dimensions of

learning to read. Reading research has shown how the reading process involves an interaction of perception, cognition, selection, organization, assimilation and the processing of word symbols into sounds and objects (Harris, 1961). Kagan, Moss and Sigel (1963) and Sigel, Jarman and Hanesian (1967) and others, have done exploratory work on "styles or categorization" and how they may play an active role in learning to read.

Over the last several decades, going as far back as Binet's development of an intelligence test to detect those children who could not profit from instructional school activities, concern over I.Q. has remained an important informational role to the educator. Cattell and Butcher (1968) have indicated that of the various "primary mental abilities, the factors such as verbal meaning are better predictors of school achievement" (p. 51). Over the years, a significant relationship between reading and I.Q. has been determined by many researchers. In particular are those cited by Chester (1974). However, other work done by Ames and Walker (1964), Haggard (1957), and research reviewed by Harris (1966, 1967) indicated that other factors besides intelligence are determinants of reading ability. Most notable of these other factors for this study has been the work of Witkin and his associates with the concepts of field dependence and field independence.

Witkin (1962) has sought to identify these styles of cognitive functioning and to understand the congruence between these styles and the individual's psychological personality. His most recent work deals with the educational implications of FD and FI styles (Witkin, 1975). Other researchers have also begun to assess these

styles and their relationship with numerous other abilities, attributes of personality and intellectual functioning (Witkin, 1973, 1975).

Field Dependence and Field Independence

Witkin, Dyk, Paterson, Goodenough and Karp (1962) state:

> The person with a more field-independent way of perceiving tends to experience his surroundings analytically, with objects experienced as discrete from their backgrounds. The person with a more field-dependent way of perceiving tends to experience his surroundings in a relatively global fashion, passively conforming to the influence of the prevailing field or context (p. 35).

Witkin and his associates have used three different methods of assessment to identify field dependent/field independent cognitive styles. The first can be classified as examining a subject's ability to orient an object in space called the Body Adjustment Test (BAT). Witkin's (1949) early work involved the use of tasks involving a tilting room and/or chair. The subject's task was to evaluate and adjust the position of his body and of the surrounding field in relation to the true vertical. The subject's score represented the deviation of the chair's adjusted position from the true upright.

A modified version of the same task widely used today is the Rod and Frame Test (RFT) (Witkin, Lewis, Hertzman, Meissner and Wapner, 1954). This task requires the subject to adjust a luminous rod attached within a luminous square frame to a vertical position while being in a completely dark room. This again measures the subject's perception of an item in a field. The degree of absolute deviation of the rod from true upright constitutes the subject's

score. A Portable Rod and Frame Test (PRFT) was developed by Oltman (1968).

The third approach to identifying field dependence and field independence was developed from the work of Witkin (1950) and Goodenough and Eagle (1963) who used a set of complex geometric patterns in which simple geometric designs were embedded. The amount of time to locate the simple figures was the subject's score. This form of test was termed the Embedded Figures Test (EFT). Several tests have been developed from this original EFT: a shortened form of EFT (Jackson, 1956); an easier version for young children (CHEF) (Goodenough and Eagle, 1963); the Children's Embedded Figures Test (CEFT) (Karp and Konstadt, 1971); the Group Embedded Figures Test (GEFT) (Witkin, Ottman, Raskin and Karp, 1971); and the Hidden Figures Test (HFT) (Educational Testing Service, 1962). All of these tests have had satisfactory reliability coefficients in terms of both internal consistency and test-retest analyses (Dumsha, 1973), (Witkin, et al. 1971), (McDaniel, 1973).

Field Dependent and Field Independent Development

At birth, the infant does not have the ability to perceive or effectively differentiate between any stimuli which may emanate from within himself or from his environment. As the child matures, the ability to differentiate increases within individuals at certain degrees. Witkin and associates (1962) indicate that:

> Development toward greater differentiation involves progress from an initial relatively unstructured state, which has only limited segregation from the environment, to a more structured state, which has relatively definite boundaries, and which is capable of greater specificity of function (p. 22).

The differentiation, according to Witkin (1954) and Faterson and Witkin (1970), develops as a function of at least four indicators. These include:

1. an articulated way of experiencing the world
2. a differentiated self as reflected in a more clearly defined body concept
3. a developed sense of separate identity
4. a specialized, structured system of controls and defenses.

Years of research by Witkin and his colleagues have, after repeated trials, lead to the conclusion that, although there are small but consistent sex differences for those subjects taking the tests, the sex differences may not be present before the age of eight or in geriatric groups (1971). Also, age-related changes are clearly defined. Developmental curves for the 8 to 24 year old period show a marked continuous increase in field independence between the ages of 8 to 15 years, although in this period the rate of change slows down with increasing age. At the same time, males between the ages of 8 to 17 appear to be more field independent than females (Witkin, Goodenough and Karp, 1967).

> During the growth years, an individual's standing on the field-dependence dimension shows marked relative stability i.e., test-retest correlations for measures of field dependence tend to be very high. Another way of expressing this relative stability is to say that children tend to hold the same position relative to their age peers on the field-dependence dimension as they grow up, while as a group they show movement toward greater field independence (Witkin, et al. 1971, pp. 5-6).

Similar relative stability over time has also been established by the work done by Dryer, Nebelkopf and Dryer (1969). Longitudinal

studies of field dependence for individuals covering the 10 year old to 24 year old period have shown significant evidence of the relative stability of field dependence during those growth years (Witkin, et al. 1967).

Depending upon the relative amount of differentiation, an individual can be placed along a continuum which varies from very field dependent or less differentiated; that is, the performance range of perception is strongly dominated by the prevailing field, at one end, to the very field independent or more differentiated, at the other, where the person experiences items as more or less separate from the surrounding field. Because scores from the FD and FI testing form a continuous distribution "these labels reflect a tendency, in varying degrees of strength, toward one mode of perception or the other. There is no implication that there exist two distinct types of human beings" (Witkin, et al. 1975, p. 9).

The field dependent/field independent dimension is bipolar in the sense that it does not have a clear high or low end.

> Thus, field-independent people are high in cognitive restructuring skills as well as in personal autonomy and low in social sensitivity and social skills. Conversely, field-dependent people are high in social sensitivity and social skills and low in restructuring skills and personal autonomy. With regard to level, then, the clusters of characteristics at each pole of the field-dependence-independence dimension are inversely related. This feature, in turn, makes the dimension value neutral. To the extent that people at each end of the dimension are high in some characteristics and low in others, it is not inherently better or worse to be located at one pole or the other. At each pole there are to be found characteristics that can be adaptive in specified circumstances. The bipolarity and neutral character of the field-dependent

> and field-independent cognitive styles make them distinctively different from abilities, which are both unipolar and value laden.
>
> In summary, the field-dependent and field-independent cognitive styles are process rather than content variables; they are pervasive dimensions of individual functioning; people tend to be stable over time in their standing on them; they are bipolar and value neutral. (Witkin, et al. 1977, p. 198)

The concept of FD and FI has been expanded to include an individual's intellectual problem-solving approach. The term adopted by Witkin is "analytical field approach." This involves the ability to overcome the embedding context and to experience items as discrete from the field in which they are contained. Those who are field independent operate within an analytical mode while those who are field dependent operate on a more global mode. These modes form a "cognitive clarity attitude." According to Witkin and associates (1962), the analytical approach reflects the extent to which information and impressions are discrete, structured, and assimilated. The global approach reflects the extent to which information is "blurred, confused, and unassimilated."

It has also been asserted by Witkin that reading requires a greater emphasis of relationships and abstractions, and thus a more active analytical approach is required of the student in the process of reading. It is because of this relationship that investigations between FD/FI dimensions and reading ability have been conducted.

Field Dependence/Field Independence and Reading Research

Twelve studies were located which examined aspects of field dependence/field independence and the relationship among various

reading related variables. These studies are reviewed according to grade levels: elementary, intermediate, and high school.

Elementary Grade Level Studies

Gill, Herdtner and Lough (1968) explored perceptual differences at the nursery, kindergarten and first grade levels with Negro and white children. The Modified Rod and Frame Test, a Frostig test and the Metropolitan Achievement Test were the criterion measures. The MRFT was shown to be a moderate predictor of reading success for males ($r=.45$, $p \leq .01$). Correlations for females on the Frostig subtests and the MAT were higher than those for males and were more highly correlated with predicted academic success only for females.

Smith (1973) selected thirty-four first graders. To determine cognitive style preference, students were given the Children's Embedded Figures Test, the Matching Familiar Figures Test and the Sigel Cognitive Styles test. All children were also tested with the Wechsler Intelligence Scale for Children and five reading comprehension tests of the Wisconsin Tests for Reading Skills Development. Significant relationships were found between the CEFT and reading for details, with intelligence controlled, for the females (.611, $p < .01$) and for the total sample (.480, $p < .01$). Field independent females were better able to selectively attend to and to recall details from a short paragraph than field dependent females. This relationship did not exist for males when I.Q. was controlled (p. 78). A similar relationship was also found for the ability to find the main idea or paragraph topic.

Watson (1969) examined FD and FI as measured by the Children's Embedded Figures Test with first, second and third grade boys as it related to the reading portion of the Stanford Achievement Test and the Draw-a-Person Test. In her rationale for the study, she relies heavily on the factor analytic perceptual studies of Thurstone (1944, 1949), Botzun (1951), Pemberton (1952) and Goin's (1958) work on visual perception. A common factor in these studies was found to be quite similar to Witkin's concept of FD and FI. Watson points out that the factor (perceptual closure or overcoming an embedded context) was examined in detail because "decoding from graphic to phonic patterns was shown to be the major task in early reading. The critical factor in the decoding and transfer process was found to be a graphic unit with an invariant relationship to a phonemic unit (p. 11). Significance was found for Paragraph Meaning, Word Study Skills and Total Reading. Watson found "that field independent boys in grades one through three are better readers than field dependent boys of the same age" (p. 43).

Santostefano, Rutledge and Randall (1965) explored cognitive styles with twenty-four boys aged 8 to 13 who were classified as remedial readers. A control group of twenty-three boys of the same age, but classified as good readers, was used for the study. The results of the study led the authors to state:

> To accomplish the task of reading, an individual's ego must call upon a particular constellation of cognitive mechanisms or principles which actively select, organize, assimilate and process shapes and forms which ultimately are learned as symbols representing sounds and objects. The failure to have available these critical mechanisms results in a reading disability (p. 61).

Kaplan (1969) explored possible correlations between cognitive styles, personality and reading achievement. One-hundred fourth grade students took the Embedded Figures Test and the Metropolitan Reading Achievement Test. Reading achievement correlated with field independence (r = .464 at the .01 level).

Wineman (1971) used subjects in the 4th, 5th, and 6th grades and examined FD/FI by evaluating human figure drawings for sophistication using the methods described by Witkin, et al. (1962). Wineman found significant correlation coefficients between the California Reading Test scores for male and female 4th grade subjects on the human drawing analysis but not for the 5th grade subjects. Significant correlations ($p < .01$) were found for both males and females on Reading Vocabulary (r_b = .49 and .92) and Reading Comprehension (r_b = .52 and .97).

Fiebert (Wineman, 1971) found low-level relationships between FI and the reading ability of deaf girls but not for deaf boys when using the Rod and Frame Test, the Children's Embedded Figures Test and the Popplreuter Test to determine differentiation.

Intermediate Grade Level Studies

Cohn (1968) dealt in some depth with the relationship between FD/FI and reading comprehension in 6th grade students. He tested a total of 123 students--59 boys and 63 girls--with the EFT, the Lorge Thorndike Intelligence Test and the Sangren-Woody Reading test. His results showed a significant positive relationship existed between EFT and four reading subtests: Details, Main Ideas, Sequence and Total Reading Score. Cohn summarized much of his study by commenting that:

> Field independence was positively and significantly correlated with those aspects of comprehension that required reorganization of a field to solve a problem, apparently when the solution had to be found through new cognitive activity rather than through reliance upon experience and external authority. This study is the first one known to this writer which links specific aspects of reading comprehension and perception together (pp. 476-477).

McDaniel (1973), when researching ten motion picture tests of perceptual ability, found that at the 6th grade level six of the ten tests used for the study correlated significantly with reading scores as measured by the Iowa Tests of Basic Skills. The objective was to build testing instruments useful in identifying and describing characteristics of perceptually handicapped children. In the 8th grade, seven of the ten tests had significant correlations ($p = .05$). The Embedded Figures Test and the Spatial Orientation of Objects Test had the highest correlations with reading scores with a range of .21 to .65 ($r = .194$ at the .05 level). Analysis suggested that "the ability to recognize visual patterns accurately among distracting elements may be among the more important perceptual processes related to severe reading disabilities" (p. 758).

Stuart's (1967) study used the Embedded Figures Test with eighty-three students in grades seven and eight. Reading ability was based on the Metropolitan Reading Achievement Test. Stuart indicated that his New York City population presented limitations but "it appears that field independence may be associated with better reading skills and identification of individual perceptual styles before reading instruction is initiated might prove useful for planning" (p. 138).

Harootunian (1961) discussed reading and closure as they related to other variables. He used 208 seventh and eighth graders and found that the Concealed Figures Test had the highest relationship to reading performance when measured against several other variables. His explanation of the results was that "flexibility of closure, as measured by Concealed Figures, elicits abilities of a higher order, abilities such as planning ahead, breaking the whole into its parts, seeing the relationships between parts, reorganizing patterns, ..." (pp. 343-344).

High School Level Studies

Peterson and Magaro (1969) used the EFT with twenty high school students--10 regular students and 10 special education students and failed to confirm the following hypotheses with significant correlations:

1. Scores on the EFT will be significantly correlated with reading achievement when intelligence is partialed out, and
2. In the learning of a reading related task, increased embeddedness will have a more retarding effect on the learning rate of field dependant than independent subjects.

Reading correlated .83 with I.Q. and -.60 for the EFT ($p = .01$). The negative correlation was expected due to the inverse relationship between reading and the time required to isolate the embedded figures on the EFT. When the effect of I.Q. was factored out, the correlation for the EFT and reading was .32 which was not significant at the .05 level. The authors did note, however, that while not statistically confirmed, the results were in the predicted direction

and "that field dependence as measured by such tests as the EFT is a correlate of reading achievement" (p. 294).

After reviewing the results of these studies, it was apparent that there was a need to continue studying the relationship between reading and the perceptual styles of field dependence and field independence while partialing out the possible influence of sex and I.Q. differences.

Summary and Educational Implications

Cohn (1968) made a pertinent educational point in his study.

> Many teachers and parents have discussed poor achievers with this writer. They usually express the belief that because a given student cannot read well he cannot cope with the rest of the curriculum. The implication is quite clear that the reading difficulties are the cause of the other learning problems. They feel that if this cause could be eliminated the student's poor performance in the other curriculum areas would disappear and he would be well on the way to the kind of life normally associated with successful achievement. This is a logical and attractive point of view. It may well be, however, that it is not correct. We may yet learn that reading difficulty, instead of being a cause of the other problems is, like them, only an effect which is the result of a kind of cognitive style that makes for less effective functioning in dealing with the total environment, of which school work is only a part (pp. 476-477).

Cohn's point may be well taken; if a particular cognitive style impedes the school success of a student, then perhaps it is not the student's style which is wrong but instead the curriculum with which he has to cope. If individualization is to work in any classroom, then the type of instruction, the materials and even the style of education, in general, must fit the student's own personal perceptual style.

Paclisanu (1970) found that field dependent students learned significantly better when they had extrinsic-social reinforcement. This came from external sources in the form of the teacher's verbal approval and praise. The field independent students learned significantly better on the task-oriented objectives with an intrinsic-nonsocial type of reinforcement. Renzi (1974) found that with self-instructional programmed materials some students improved, others showed no effect and some were hindered. He looked for the variable which caused the differences and found that field dependence would interact to produce differential effects on the performance and achievement of the subjects. Coop (1971) reports two studies which compared cognitive styles with teaching method. The first, Scott and Sigel (1965) indicated that at least at the fourth and sixth grade levels, student's cognitive styles can be modified somewhat by the teaching method to which they are exposed. They concluded that "stylistic preferences of the 'Inquiry' (one of the techniques used in the study) children were definitely related to the problem-solving strategy used in the science lessons" (p. 157). The second, by Beller (1967)

> Appears to shed some light on the question of designing a teaching method to facilitate individuals with particular cognitive styles... Beller found that when the children were trained with a method congruent with their cognitive style, they showed positive changes in performances on the dependent measures; when children were trained with a method dissonant to their cognitive style (i.e., analytic children trained with a nonanalytic method and nonanalytic children trained with an analytic method), a negative change in performance on a pre- to posttest measure resulted (p. 157).

Witkin (1975) suggests that educators teach students to use problem-solving strategies most appropriate to their styles and even to instruct them how to shift to strategies more suitable for the task at hand rather than their preferred strategies. He further points out some implications for classroom use. Because of their more social orientation FD students are more adept in learning materials and remembering things which have a social content. Those students who are FI operate somewhat at a disadvantage when it comes to the social content. Teachers can help the FI student "by bringing social material to focal attention, as was done in studies which made the learning of such material an intentional task" (p. 29).

Kogan (1971), Gordon (1966) and Smith (1973) have all suggested that an inductive or discovery approach might be the most effective for those students with a more field independent style, while a more didactic, teacher directed method might best benefit those students who manifest a preferred field dependent style.

Bruner (1966) aptly describes the interplay between recognizing individual differences and determining strategies and goals for effective education:

> Individual differences...exist in massive degree--in the extent to which children have problem-solving predispositions, in the degree of their interest, in the skills that they bring to any concrete task, in their preferred mode of representing things, in their ability to move easily through any particular sequence, and in the degree to which they are initially dependent upon extrinsic reinforcement from the teacher. The fact of individual differences argues for pluralism and for an enlightened

> opportunism in the materials and methods of instruction. Earlier we asserted, rather offhandedly, that no single ideal sequence exists for any group of children. The conclusion to be drawn from that assertion is...that if a curriculum is to be effective in the classroom, it must contain different ways of activating children, different ways of presenting sequences, different opportunities for some children to "skip" parts while others work their way through, different ways of putting things. A curriculum, in short, must contain many tracks leading to the same general goal (p. 71).

A positive relationship between reading achievement and cognitive style was indicated by the review of the literature at the elementary, intermediate and high school levels. In particular, a strong relationship between field independence and reading is noted as well as between cognitive styles and learning tasks. Students who exhibit field independent attributes experience a greater degree of academic and reading success than do field dependent students, especially when the focus is clearly determined and the tasks are self-directed as is often the case in the current educational process.

In summary, the research on cognitive style suggests that there is tremendous variability in the way in which students process information, perceive instructional tasks, cope with analytical or nonanalytical materials and hence in the manner in which they deal with instructional programs, reading or otherwise.

CHAPTER III

PROCEDURE

Introduction

A description of the subjects, the procedures and the testing instruments used to obtain the criterion measures for cognitive style and reading achievement are described in this chapter.

Population

The subjects for the study were the entire population of 240 male and female sixth grade students from the Hillside Middle School of the Bridgewater-Raritan Regional School District, Bridgewater, New Jersey.

Bridgewater Township is a suburban community consisting almost entirely of a white middle and upper-middle class population. Bridgewater has changed over the last two decades from a rural community to a suburban community with the conversion of farm and wooded land into housing tracts. The population, according to an updated 1970 U. S. Census Report was 32,034 with a reported annual median family income of $16,512.00. The school population of almost 10,000 students indicates that families with children have moved into the township during its recent developing years. Employment is primarily in the community itself. The township

boasts one of the largest industrial parks in the state as well as nationally operated industrial corporations. The majority of the employed citizens are in management, office, skilled labor, proprietors and technological positions.

The entire sixth grade class, consisting of nine classroom groups, comprised the population for the study. No student was removed from the study because he was from any special program, i.e., Academically Independent Class, Resource Room or supplemental instruction. Removal of any student was avoided so as to not skew the population toward any one performance extreme. The exclusive use of the sixth grade for this study was decided upon for the following reasons:

1. Cognitive style is somewhat more stable at this age than it is at earlier or later school related ages (Paterson and Witkin, 1970; Witkin, et al. 1967; Witkin, et al. 1975; and Yeatts, 1971).
2. This group of students tends to operate as a complete unit for reading instruction which is done at the same time period each day of the week in homogeneous reading groups.
3. The test used to determine cognitive style for the study cannot be used with much validity at lower grade levels.
4. The standardized reading achievement test given at this grade level over the last several years has been shown reliable and provides a satisfactory frame of reference.

5. The use of the sixth grade limits the age range, so that age need not be considered a variable.

Testing Instruments

Measure of reading achievement.--

The vocabulary and reading comprehension subtests of the Iowa Tests of Basic Skills, Form 4, Grades 3-9, 1964 edition, were used as the measure of reading achievement.

The vocabulary subtest for grade six began with item number forty on page five and ended with item number eighty-five on page six. Testing time given for the students to complete the test was seventeen minutes working time. The vocabulary subtest measures the general skills:

1. the use of the tools involved in word recognition
2. knowledge of the meaning of words
3. sensitivity to fine differences in meaning and judgment in choosing the most appropriate word in a given contextual situation.

The reading comprehension subtest for grade six began with item number sixty-one on page fourteen and ended with item one-hundred thirty-six on page twenty-one. The testing time to complete the seventy-six questions was fifty-five minutes. The reading comprehension subtest measures skills which fall into four classifications:

1. to recognize and understand stated or implied factual details and relationships
2. to develop skill in discerning the purpose or main idea of a paragraph or selection

3. to develop ability to organize ideas

4. to develop skill in evaluating what is read

The test was standardized on a large school population "drawn from the total sample of all public school children in the United States in grades 3 through 9" and reliability coefficients range from ".84 to .96 for the major tests and from .70 to .93 for the subtests," (Buros, 1959, pp. 31-32).

V. E. Herrick states that the test has as a major strength its curricular validation.

> Besides the usual wide-spread administration of sample test items and the establishment of discrimination and difficulty indexes, extremely careful identification and definition of the skill processes being tested was done before test items were devised. This aspect of test development is not usually undertaken with such care, and the authors are to be commended for the way the curricular validation of their test items was done (Buros, 1959, p. 32).

Measure of Cognitive Style.--

The Group Embedded Figures Test (GEFT) was used as the measure of field dependent and field independent cognitive styles. The GEFT was designed as an adaptation of the original individually administered Embedded Figures Test which would make group testing possible (Witkin, 1950; Witkin et al. 1962).

The GEFT is a perceptual test. The subject is to locate a previously seen simply drawn outline figure which has been embedded or organized within a more complexly drawn figure so as to obscure the simple figure. Scores reflect the subject's ability at perceptual disembedding (Witkin et al. 1971).

As related by Witkin, Oltman, Raskin, and Karp (1971), the rationale for using embedded figures tests to make inferences about the dimensions of a subject's personal functioning are well researched and documented. Additional aspects considered are:

> Cognitive styles are the characteristic, self-consistent modes of functioning which individuals show in their perceptual and intellectual activities. These cognitive styles are manifestations in the cognitive sphere of still broader dimensions of personal functioning which cut across diverse psychological areas. The emphasis in research on cognitive style has been on the adaptive functions served by cognitive processes in the psychological economy of the individual (p. 3).

The GEFT has validity coefficients of .82 and .63 for males and females, respectively, when compared with the EFT (Witkin, et al. 1971, p. 29). The EFT has a fairly high reliability as shown by odd-even correlations of .87 for men and .74 for women (Witkin, 1950, p. 15).

The GEFT is divided into three sections. There are a total of twenty-five complex figures for the test. Section One with seven figures was for practice and two minutes of time was given for the subject to complete the section. Section Two and Section Three are the actual test. Each section contained nine complex figures which had simple figures embedded. The subject was allowed five minutes to complete each section. Since this test was being used near its lower age limit, times were extended to seven minutes per section. The extended time limit procedure was acceptable according to a pilot study done by Witkin (1971, p. 28).

For the purposes of this study, a subject who received a GEFT score above the median of the total group was considered to have a

field independent tendency. A subject whose score was at or below the median for the group was considered to have a field dependent tendency. After the GEFT was administered to all sixth grade students during the month of January, 1977, the tests were scored by this investigator and the scores ranked as indicated by the frequency distribution in the Appendix. The median score was 11 for the 18-item test with a range of zero as minimum to eighteen as maximum. The high/low twenty-seven percent (Fan, 1952, 1954) of the 222 students at either end of the cognitive style continuum were classified as FD or FI in order to give the study a tighter design in terms of identifying students as either field dependent or field independent and for greater statistical reliability.

Thus, those 60 students who scored at the low end of the distribution were designated field dependent (FD). Conversely, those 60 students whose scores were at the high end of the distribution were designated field independent (FI) (Witkin, et al. 1971).

For the purposes of this study only the above designated students, i.e., 60 FD and 60 FI, and their data were used for statistical analysis and for hypotheses investigation.

Measure of Intelligence Quotient.--

The Lorge-Thorndike Intelligence Test, Form 2, Levels A-H, 1954 and 1964, was used as the measure of I.Q. The test yields a verbal I.Q., a non-verbal I.Q. and a total I.Q. Freeman in Buros (1959) commends the test as:

> Among the sounder group of instruments available, from the point of view of psychological insights shown in selecting and developing materials, and

from the point of view of statistical analysis of the standardization data (p. 481).

Administration of the Tests

Iowa Tests of Basic Skills - Form 4.--

Subtests for vocabulary and reading comprehension were administered October 1976 by the subjects' individual classroom teachers during reading period. Testing was completed during two testing days.

Day 1 - Answer sheet was completed and the vocabulary test was given as per the instructions in the examiner's manual.

Day 2 - Reading comprehension subtest was completed as per the instructions in the manual.

Group Embedded Figures Test.--

The GEFT was administered to all students in their reading groups during their reading periods. Testing was done one reading group at a time by the investigator with the assistance of the classroom teachers. Testing was completed during the month of January, 1977, following the time limits previously set and the directions for administering the GEFT in the Embedded Figures Manual.

Intelligence Quotient

I.Q. scores were collected for those subjects used in the study to assess a subject's relative intellectual ability and to access if I.Q. had any significant effect on the other variables considered in the study. For this purpose, the most recent (Grade 4) Lorge-Thorndike I.Q. scores which were available from the school's

regular I.Q. testing program were collected. This test yielded three separate scores: verbal intelligence, non-verbal intelligence and the average of these two scores or total I.Q. For purposes of analysis only the two subtest scores were used.

The I.Q. scores collected for the study were controlled through a covariate analysis. Through this type of statistical design, I.Q. is considered a potentially confounding variable and is thus treated as a control variable to be neutralized rather than a moderator variable to be assessed.

Sex Factors

Although some researchers, especially Witkin (1971), have found some sex differences in field dependent/field independent subjects, others have not. The sex of each subject was also recorded in order to check if sex had any influence upon the variables in the study.

Statistical Design

This study is a correlational design which involves the collection of two or more sets of data from a group of subjects with the attempt to determine the subsequent relationships between those sets of data.

This type of study can be diagrammed as follows: O_1, O_2, O_3.

Generally, correlational studies serve in determining if there are relationships among observed measures and suggesting possible bases for causality.

CHAPTER IV

FINDINGS AND DISCUSSION

Introduction

The purpose of this study was to investigate cognitive style and its relationship to reading achievement. Specifically, the intent of the study was to determine the relationship between field dependence/field independence and reading vocabulary/reading comprehension as differentiated by sex and I.Q. among sixth grade students.

The data of this study were derived from testing two-hundred forty sixth grade boys and girls. A cognitive style determinant test, the Group Embedded Figures Test, was given to differentiate field dependent and field independent subjects. Intelligence test scores for the Lorge-Thorndike I.Q. test were secured from school records which yielded verbal, non-verbal and total I.Q. scores. Reading achievement scores were obtained through the administration of the vocabulary and comprehension sections of a standardized achievement test--the Iowa Tests of Basic Skills. Eighteen students were removed from the study because of insufficient data due to illness during either of the tests or school records for I.Q. being incomplete. This left two-hundred twenty-two students with complete

data who were used for the study. Final analysis was completed for the upper and lower 27 percent of the study population or a total of one-hundred twenty subjects classified as either field dependent or field independent.

Statistical analyses used were a t-test, chi-square, Pearson product-moment correlation coefficient, biserial correlations, analysis of variance and analysis of covariance.

Basic data for both the FI and FD groups are presented in Table 1. Several sets of scores should be noted. First, the means on the vocabulary subtest are 24.51 for the FD group and 30.88 for the FI group. Second, the comprehension means are 34.26 for the FD group and 45.96 for the FI group. Also of interest was the disparity between the groups relative to intelligence. The means for total I.Q. were 102.92 for the FD group and 119.85 for the FI group. The FD group was only slightly better than the average established I.Q. score of 100 while the FI group was more than one standard deviation above the norm. The GEFT as a test of cognitive style preference was able to designate two distinct ability groups, i.e., reading and intelligence levels, from the total population. Of secondary interest was whether the GEFT was a better indicator of intelligence and perceptual learning modality rather than, as stressed in the research, an indicator of reading ability.

Plan of the Chapter

This chapter is arranged so as to have each hypothesis with subsequent statistical analyses examined and discussed.

TABLE 1

FIELD DEPENDENT/FIELD INDEPENDENT GROUP MEANS AND STANDARD DEVIATIONS FOR READING ACHIEVEMENT: VOCABULARY AND COMPREHENSION RAW SCORES, INTELLIGENCE QUOTIENT: VERBAL, NON-VERBAL AND TOTAL SCORES, AND COGNITIVE STYLE: FIELD DEPENDENT/FIELD INDEPENDENT (N=120)

Variable	Field Dependent $\bar{X}$	Field Dependent SD	Field Independent $\bar{X}$	Field Independent SD
Reading Achievement				
Vocabulary	24.51	7.47	30.88	6.83
Comprehension	34.26	11.78	45.96	11.76
Intelligence Quotient				
Verbal	100.93	10.18	114.00	10.94
Non-Verbal	103.86	12.98	125.18	12.53
Total	102.92	10.53	119.85	10.52
Cognitive Style				
GEFT	4.51	1.91	15.73	1.19
Total (N)	60		60	

The First Hypothesis

Hypothesis One compared the field dependent (FD) and the field independent (FI) groups according to the vocabulary subtest scores when intelligence was controlled.

The raw score vocabulary means for the FI group (30.88) and the FD group (24.51) as well as the standard deviations were previously noted in Table 1. When the two I.Q. subtest scores were controlled through a covariate analysis, which neutralized any effect I.Q. might have on the groups relative to the vocabulary scores, the adjusted means for the groups were produced. The adjusted means for the FI group were 27.97 (verbal I.Q. controlled) and 28.04 (non-verbal I.Q. controlled) and for the FD group 27.43 (verbal I.Q. controlled) and 27.38 (non-verbal I.Q. controlled). These adjusted means are presented in Table 2 for comparison.

The difference between the means for the FI and FD groups with respect to the vocabulary subtest scores were not significant when either the verbal I.Q. or the non-verbal I.Q. was controlled. The results of analysis of covariance used to control both the verbal and non-verbal I.Q. and levels of significance are presented in Appendix C. These analyses indicated that differences between the FD and FI groups with vocabulary as a dependent variable were not significant when verbal I.Q. (F = .04, PR> F .8358) and non-verbal I.Q. (F = .10, PR> F .7480) were controlled.

Thus, when I.Q. was partialed out, no significance was shown to exist between the FD/FI subjects and vocabulary. Therefore, I.Q. as a factor for the FI subjects had a contributing effect

TABLE 2

ADJUSTED MEANS OF VOCABULARY RAW SCORES WHILE CONTROLLING VERBAL AND NON-VERBAL I.Q. FOR FIELD INDEPENDENT AND FIELD DEPENDENT GROUPS

	Field Independent Mean	Field Dependent Mean	Difference	Significance
Vocabulary	30.88	24.51	6.37	.01[a]
Means Adjusted for:				
Verbal I.Q.	27.97	27.43	.54	NS[b]
Non-Verbal I.Q.	28.04	27.38	.66	NS[b]
N	60	60		

[a] t-test analysis in the Appendix.

[b] Covariate analyses in the Appendix.

for this group since the mean on the vocabulary subtest was initially much higher than that of the FD group until I.Q. was controlled. The null hypothesis of a relationship between vocabulary and cognitive styles when controlling for I.Q. was accepted.

The Second Hypothesis

Hypothesis Two compared the field dependent (FD) and the field independent (FI) groups according to the comprehension subtest scores with intelligence controlled.

The raw score comprehension means for the FI group (45.96) and the FD group (34.26) were previously noted in Table 1. When intelligence was controlled through covariate analysis, which neutralized any effect of intelligence upon the group comprehension scores, adjusted means for each group were produced. The adjusted comprehension means for the FI group were 41.66 with verbal I.Q. controlled and 41.43 with non-verbal I.Q. controlled. For the FD group adjusted comprehension means were 38.57 with verbal I.Q. controlled and 38.80 with non-verbal I.Q. controlled. These adjusted means for comprehension are presented in Table 3 for comparison.

The difference between the means for the FI and FD groups with respect to the comprehension subtest scores was not significant when either verbal or non-verbal I.Q. scores were controlled.

The results of covariate analysis to control for both the verbal and non-verbal I.Q. scores and levels of significance are

TABLE 3

ADJUSTED MEANS OF COMPREHENSION RAW SCORES WHILE CONTROLLING VERBAL AND NON-VERBAL I.Q. FOR FIELD INDEPENDENT AND FIELD DEPENDENT GROUPS

	Field Independent Mean	Field Dependent Mean	Difference	Significance
Comprehension	45.96	34.26	11.70	.01[a]
Means Adjusted For:				
Verbal I.Q.	41.66	38.57	3.09	NS[b]
Non-Verbal I.Q.	41.43	38.80	2.63	NS[b]
N	60	60		

[a] t-test analysis in the Appendix.

[b] Covariate analyses in the Appendix.

presented in Appendix C. These analyses indicated that differences between the FI and FD groups with comprehension as a dependent variable were not significant when verbal I.Q. (F = 1.86, PR > F .1751) and non-verbal I.Q. (F = .92, PR > F .3395) were controlled.

Thus, when intelligence was partialed out, no significance was produced between the FD or FI group and comprehension. Intelligence was the factor which contributed to the FI group having an initially higher comprehension mean (45.96) than the FD group (34.26). Therefore, the null hypothesis of a relationship between comprehension and the FD or FI cognitive styles when controlling for intelligence was accepted.

The Third Hypothesis

Hypothesis Three was concerned with sex differences between the field dependent and field independent groups.

Witkin and associates (1971) found small but consistent sex differences between males who were generally more field independent and females who were generally more field dependent.

In this study the field independent group consisted of 36 males and 24 females and the field dependent group consisted of 29 males and 31 females. Chi-square analysis (Table 4) produced no significance for the subjects of this study when comparing sex differences between the FI/FD groups.

Discussion

Significant relationships between the field dependent/field independent groups and reading achievement were not produced when

TABLE 4

CHI-SQUARE ANALYSIS OF SEX DIFFERENCES
FOR FD AND FI SUBJECTS

Group	Male	Female	Total
FI	36	24	60
FD	29	31	60
Total	65	55	120

Note: $\chi^2 = 1.21$, df = 1. A χ^2 value of 2.71 is needed for significance at the $p < .05$ level.

intelligence was controlled. Therefore, Null Hypotheses One and Two were accepted. Generally, it was apparent that intelligence was an intervening variable which caused greater variance in the vocabulary and comprehension subtest scores between the field dependent and field independent subjects.

Chi-Square analysis comparing males and females for the FI and FD groups produced no significance so that Null Hypothesis Three was also accepted.

The results of this study do not agree with the literature previously reviewed. Often those who made comparisons between cognitive styles and reading achievement neglected to consider intelligence as a confounding factor. Using the subjects and the data of the present study, while not considering I.Q., will produce significant levels of correlation between FI/FD and reading achievement. A t-test analysis was completed for FI/FD groups and vocabulary which produced a t value of 4.87, df = 118, which was significant at the .01 level. The raw score means on the vocabulary test showed the FI subjects as a group scoring significantly higher than the FD subjects. Such significance did not exist in this study with intelligence controlled.

A t-test analysis was completed for FI/FD and comprehension which produced a t value of 5.44, df = 118, which was significant at the .01 level. The raw score means on the comprehension test showed that the FI subjects had a significantly higher level of comprehension than did the FD group. Again, such significance

did not exist in the present study with intelligence controlled. Data from the t-test analyses is in Appendix B.

What has become apparent from studying the t-test results and the covariate analyses results is that cognitive styles and I.Q. are measures of the same or similar intellectual functions or dimensions. Quite possibly I.Q. was the determinant which designated the field dependent/field independent groups when using the Group Embedded Figures Test as the measure of cognitive style.

CHAPTER V

SUMMARY AND CONCLUSIONS

This study did not find any significant differences between field dependent and field independent students on either reading vocabulary or reading comprehension when intelligence was controlled. Thus, the Null Hypotheses One and Two were accepted.

When differences between males and females were examined, there was no significant difference between the number of males and females in either the field independent or the field dependent group, thus, Null Hypothesis Three was accepted.

The central finding of this study is that the Group Embedded Figures Test is very similar to an intelligence test. Field dependent students tend to score low on I.Q. tests and tend to score low on reading vocabulary and comprehension tests. Conversely, field independent students tend to score high on I.Q. tests and tend to score high on reading vocabulary and comprehension tests.

A positive and often significant relationship between reading achievement and cognitive styles is indicated by the literature. In particular, correlations suggest a very positive relationship between field independence and reading achievement, specifically,

reading for details, word study skills, main idea, sequence, and reading comprehension in general. Unfortunately, many researchers showing a relationship between field independence and reading have failed to consider intelligence as an intervening or confounding variable. Those who did found that the correlations between field independence and reading decreased or failed to reach levels of significance. Exceptions were studies for early readers where I.Q. assessment was a non-print measure (Smith, 1973).

The results of this study do not agree with the findings of the research literature reviewed due to the fact that most of these researchers did not control for intelligence or even consider intelligence in the design of their studies. Those who considered I.Q., Smith (1973) and Peterson and Magaro (1969), had results which, for the former, were different than this study and, for the latter, which agreed with this study.

In conclusion, it must be noted that the GEFT and the non-verbal section of the Lorge-Thorndike Intelligence Test were much alike in format. Analytical I.Q. and the GEFT seem to draw upon and measure similar abilities. The field independent group showed a relationship with the reading subtests. This relationship decreased when I.Q. was factored out. The suggestion that the GEFT and I.Q. are related seemed to be substantiated. Another suggestion is that, while it is similar to an I.Q. measure, the GEFT also measures factors which I.Q. tests do not fully reflect, e.g., a perceptual mode of learning and operating which is either in an analytical or global fashion.

On the basis of the data, I.Q. seems to be a better predictor of reading success than does the GEFT. What needs to be taken into account is that the GEFT is a time test which indicates a relationship between the completion of drawings, the number of items correct for the time given, efficiency and clarity of work, size and shape perception, and a classification of field dependent or field independent tendencies. Although significance was not produced between reading and cognitive styles, the inference drawn is that field dependent students require more trials and a longer period of time to master perceptual tasks. Conversely, field independent students work more quickly and exactly on the same tasks. Those students of this study who were designated field independent demonstrated the ability to successfully complete these tasks, as evidenced by the higher scores on the Group Embedded Figures Test, as well as succeed better on the reading and intelligence tests used for this study.

Suggestions for Further Research

In the search for measurable individual differences in the variables which affect a student's ability to learn to read, this study has focused upon only one small part of that dimension. It is through more precise examination of all the facets implicated in the process of reading that understanding of the cognitive mechanisms will be achieved. Further research in this field should be directed at the following:

1. Examination to determine how cognitive styles interact with the acquisition of reading skills and the total reading process with differentiation in teaching FD and FI identified students.
2. Examination of the relationships between cognitive styles, intelligence and reading comprehension/vocabulary measures as a longitudinal study.
3. Examination of field dependent/field independent testing as it relates to I.Q. testing and on what ways are they based upon common factors.
4. Examination of field dependent/field independent styles and the relationship with the various levels of comprehension.
5. Examination of the value in telling the student about his preferred FD/FI style. Does it assist in better learning through using appropriate problem-solving strategies or through modification of strategies? For the educator, the development of "greater diversity in behavior within individuals seems as important an objective as recognizing

and utilizing diversity among individuals" (Witkin, et al. 1975).

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APPENDIX A

DATA AND CORRELATIONS

APPENDIX A

FREQUENCY DISTRIBUTION OF GROUP EMBEDDED FIGURES TEST SCORES

Score	Frequency
0	2
1	2
2	7
3	7
4	8
5	11
6	14
7	14
8	16
9	10
10	14
11	25
12	15
13	12
14	12
15	26
16	8
17	14
18	5
Total	222

MEANS AND STANDARD DEVIATIONS FOR FD/FI GROUPS AS DIFFERENTIATED BY SEX FOR VOCABULARY, COMPREHENSION, VERBAL, NON-VERBAL AND TOTAL I.Q.

Group	N	Vocabulary $\bar{X}$	Vocabulary SD	Comprehension $\bar{X}$	Comprehension SD	Verbal I.Q. $\bar{X}$	Verbal I.Q. SD	Non-Verbal I.Q. $\bar{X}$	Non-Verbal I.Q. SD	Total I.Q. $\bar{X}$	Total I.Q. SD
Field Dependent	60										
Male	29	25.41	8.71	33.93	13.70	99.75	10.48	101.72	11.74	101.00	9.84
Female	31	23.68	6.11	34.58	9.88	102.03	9.92	105.87	13.92	104.71	10.98
Field Independent	60										
Male	36	31.25	6.55	46.41	11.82	112.75	10.50	124.77	13.39	119.02	10.81
Female	24	30.33	7.35	45.29	11.89	115.87	11.54	125.79	11.37	121.08	10.15

MATRIX OF CORRELATION COEFFICIENTS FOR FD AND FI SUBJECTS FOR SEX, VOCABULARY, COMPREHENSION, I.Q. AND GEFT

FIELD DEPENDENT

	Sex	Voc.	Comp.	VIQ	NVIQ	IQ	GEFT
Sex							
Voc.	-.117						
Comp.	.027	.716*					
VIQ	.112	.637*	.619*				
NVIQ	.161	.480*	.482*	.638*			
IQ	.177	.577*	.588*	.847*	.914*		
GEFT	.122	.199	.113	.079	.196	.175	

$N = 60$

*$p \leq .05$

FIELD INDEPENDENT

	Sex	Voc.	Comp.	VIQ	NVIQ	IQ	GEFT
Sex							
Voc.	-.066						
Comp.	-.047	.747*					
VIQ	.141	.636*	.542*				
NVIQ	.039	.430*	.428*	.617*			
IQ	.096	.582*	.533*	.883*	.913*		
GEFT	.069	.035	.063	-.075	.165	.058	

$N = 60$

*$p \leq .05$

MATRIX OF CORRELATION COEFFICIENTS FOR TOTAL GROUP OF FD/FI SUBJECTS FOR SEX, VOCABULARY, COMPREHENSION, VERBAL I.Q., NON-VERBAL I.Q., TOTAL I.Q., AND GROUP EMBEDDED FIGURES TEST

N=120

	Sex	Voc.	Comp.	VIQ	NVIQ	IQ	GEFT
Sex							
Voc.	-.132						
Comp.	-.060	.779*					
VIQ	.045	.708*	.676*				
NVIQ	.002	.582*	.600*	.747*			
IQ	.032	.668*	.671*	.903*	.948*		
GEFT	-.085	.427*	.453*	.513*	.657*	.633*	

*$p \leq .05$

APPENDIX B

t-TEST ANALYSIS OF READING ACHIEVEMENT MEANS

APPENDIX B

t-TEST ANALYSIS OF MEANS FOR VOCABULARY AND COMPREHENSION

VOCABULARY MEANS, STANDARD DEVIATIONS AND VARIANCES FOR FD AND FI GROUPS

Group	N	Mean	SD	Variance
FD	60	24.51	7.47	55.77
FI	60	30.88	6.83	46.78

Note. $t = 4.872$, $df = 118$, $p < .01$, $r = 2.358$

COMPREHENSION MEANS, STANDARD DEVIATIONS AND VARIANCES FOR FD AND FI GROUPS

Group	N	Mean	SD	Variance
FD	60	34.26	11.78	138.87
FI	60	45.96	11.76	138.37

Note. $t = 5.445$, $df = 118$, $p < .01$, $r = 2.358$

APPENDIX C

COVARIATE ANALYSES

APPENDIX C

ANALYSIS OF COVARIANCE CONTROLLING FOR VERBAL I.Q.
WITH VOCABULARY AS A DEPENDENT VARIABLE

Source	df	SS	F	PR>F
Verbal I.Q.	1	2571.06	86.38	.0001**
FD/FI	1	1.28	.04	.8358
Sex	1	185.62	6.24	.0139*
FD/FI X Sex	1	1.42	.05	.8273
Error	115	3422.82		

*p < .05

**p < .01

ANALYSIS OF COVARIANCE CONTROLLING FOR NON-VERBAL I.Q.
WITH VOCABULARY AS A DEPENDENT VARIABLE

Source	df	SS	F	PR>F
Non-Verbal I.Q.	1	1342.69	33.20	.0001*
FD/FI	1	4.19	.10	.7480
Sex	1	119.23	2.95	.0887
FD/FI X Sex	1	20.01	.49	.4832
Error	115	4651.19		

*p < .01

ANALYSIS OF COVARIANCE CONTROLLING FOR VERBAL I.Q.
WITH COMPREHENSION AS A DEPENDENT VARIABLE

Source	df	SS	F	PR>F
Verbal I.Q.	1	5624.79	60.41	.0001*
FD/FI	1	173.34	1.86	.1751
Sex	1	114.49	1.23	.2698
FD/FI X Sex	1	40.03	.43	.5133
Error	115	10708.32		

*p< .01

COVARIATE ANALYSIS CONTROLLING FOR NON-VERBAL I.Q.
WITH COMPREHENSION AS A DEPENDENT VARIABLE

Source	df	SS	F	PR>F
Non-Verbal I.Q.	1	3431.74	30.59	.0001*
FD/FI	1	103.21	.92	.3395
Sex	1	51.70	.46	.4986
FD/FI X Sex	1	1.41	.01	.9106
Error	115	12901.37		

*p< .01